# MISSION OPERATIONS AGREEMENT

## GLAST
## Mission Operations
## Roles and Responsibilities

~~February 6~~June 30, 2004

DOCUMENT APPROVAL

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REVISION STATUS

The GLAST Project Configuration Control Board (CCB) controls this document. Proposed changes shall be submitted to the GLAST Project CCB for approval

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# OPEN ITEMS

This table lists the items that remain open as of the publication of this version of the document. As they are closed the resolutions will be incorporated into the body of the document.

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OPEN ACTIONS

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# 1.0 INTRODUCTION

## 1.1 PURPOSE

The purpose of this document (referred to herein as the Operations Agreement or Agreement) is to delineate the roles and responsibilities of the various organizations involved in preparing for and conducting launch, early orbit, and normal operations support for the GLAST observatory. These organizations collectively make up the GLAST **Mission Operations Team (MOT)**, and include the following:

- **Spacecraft Contractor** – Spectrum Astro Incorporated (SAI) (referenced as Spectrum Astro or Spectrum in this document), is responsible for ~~implementing~~ building the spacecraft, integrating the observatory and delivering it to NASA on-orbit within launch +60 days. Delivery to NASA is predicated on validation of spacecraft functionality and bus-to-instrument interfaces. Nominally, Spectrum Astro will also provide sustaining engineering support for the spacecraft after launch +60 days pending contract negotiations with NASA.
- **Flight Operations Team (FOT)** – Responsible for implementing the Mission Operations Center (MOC) to support pre-launch, launch, early orbit, and normal operations activities. Also responsible for providing science and flight operations support. Implementation and flight operations team support ~~primarily initially~~is being provided by Goldbelt Orca/Omitron.
- **GLAST Science Support Center (GSSC)** – The GSSC is responsible for providing GLAST processed data, analysis software and documentation to users, and will support the Guest Investigator (GI) program. During nominal operations, the GSSC will provide the science timeline to the MOC.
- **Instrument Operations and science Teams (IOTs)**– The IOTs are ~~-~~responsible for ~~implementing~~ developing the LAT and GBM instruments, including the flight software. They also provide instrument sustaining engineering support for the life of the mission. The Stanford Linear Accelerator Center (SLAC) provides LAT support and the National Space Science and Technology Center (NSSTC) provides GBM support. The instrument teams' roles in the operations organization relative to the instruments are comparable to Spectrum's role as spacecraft contractor.
- **NASA (GLAST Project)** – Provides overall support for end-to-end ground system implementation and test activities, and mission (science and flight) operations including Flight Dynamics support, Networks and Ground Station support.

## 1.2 SCOPE

The scope of this Operations Agreement (OA) includes the definition of roles and responsibilities of the organizations that will collectively support the preparation for and conduct of GLAST spacecraft and instrument operations. The organizations are those listed in section 1.1. This Agreement is controlled and managed by the GLAST Project CCB.

This Agreement does not include detailed descriptions of (1) the mission science goals or plans, (2) ground system, spacecraft or instrument architecture/design, or (3) overall mission operations concepts and scenarios. These areas are covered in other documents. It is assumed that the

reader of this Agreement is already familiar with these topics for the mission, and thus, they do not need to be addressed here.

## 1.3 REFERENCE DOCUMENTATION

The following documents provide reference information. In case of conflicting requirements or statements, the information provided in this Operations Agreement applies.

1. Gamma-Ray Large Area Space Telescope (GLAST) Project Mission Operations Concept Document (OCD), Revision A, 433-OPS-0001, July 16, 2003
2. GLAST Ground System Project Plan Final, February 6, 2004
3. GLAST Ground System Test Plan Draft, September 30, 2003
4. GLAST Project Database Format Control Documents (DFCD) Draft, November 21, 2003
5. GLAST Ground System Requirements Documents (GSRD), October 14, 2003
6. GLAST Project Procedure/PROC Style Guide Draft, 492-MOC-004, December 1, 2003
7. Statement of Work for the GLAST MOC and Mission Operations Support, Revision A, 433-SOW-0003, October 3, 2003
8. MSS

## 1.4 APPLICABLE DOCUMENTATION

1. Flight Operations Plan (FOP) – CDRL 7
2. Observatory Operations Description Manual (OODM) - CDRL 5
3. Telemetry and Command (T&C) Handbook - CDRL 6
4. Mission Operations Readiness Plan (MORP)
5. Flight Operations Manual (FOM)

# 2.0 MISSION OPERATIONS OVERVIEW

The GLAST observatory is comprised of two instruments, the Large Area Telescope (LAT) and the Gamma-Ray Burst Monitor (GBM). Stanford University is leading the development of the LAT instrument, while NASA Marshall Space Flight Center (MSFC) is leading the development of the GBM instrument.

Spectrum Astro is developing the spacecraft and leading observatory integration and test (I&T) (i.e., integration of the spacecraft and instruments). Spectrum is delivering the spacecraft to NASA on-orbit (vs. prior to launch), where delivery of the spacecraft to NASA is predicated on validation of the observatory functionality.

Mission operations will be supported from the Mission Operations Center (MOC) facility located at the NASA Goddard Space Flight Center (GSFC) Greenbelt, MD. Flight Operations Team (FOT) personnel, supplied under contract by Goldbelt Orca/Omitron, will provide lead flight operations support.

The LAT Operations Team located at the LAT Instrument Science and Operations Center (LISOC) at Stanford University will provide lead operations support for the LAT instrument.

The GBM Operations Team located at the GBM Instrument Operations Center (GIOC) at the National Space Science and Technology Center (NSSTC) in Huntsville, AL and is a collaborative effort between Marshall Space Flight Center, the University of Alabama in Huntsville (UAH) in the U.S. and the Max Planck Institute for Extraterrestrial Physics (MPE) in Garching, Germany will supply operations support for the GBM ~~instrumen~~instrument. The GBM Instrument Operations Team is also responsible for the development and operation of ~~t~~ the Burst Alert Processor (BAP).

Located at the Laboratory for High Energy Astrophysics (LHEA)(Code 660) at GSFC, the GLAST Science Support Center is the interface between the GLAST mission and the scientific community. The GSSC will provide GLAST data, analysis software and documentation to users, ~~and will support~~ administer the Guest Investigator program and support BAP operations at GSFC.

## 2.1 MISSION OPERATIONS PHASES

The GLAST mission consists of three main operations phases: the Pre-Launch, Launch and Early Orbit, and Normal Operations phases. These are described in the sections that follow. It is important to establish a common understanding of these phases since the organizational roles and responsibilities discussed in Section 3 vary for each phase.

### *2.1.1 Pre-Launch*

The Pre-Launch mission operations phase includes all activities related to preparing to support operations during launch, early orbit, and normal operations, such as the definition of spacecraft and instrument operations requirements, coordination with external support organizations to define operational interfaces, and the development and validation of operations plans, procedures, and other documentation. Mission operations preparation also includes the planning

and conduct of operations training, simulations, and rehearsals for the operations teams. The Pre-Launch phase ends at launch.

### *2.1.2 Launch and Early Orbit*

The Launch and Early Orbit (L&EO) phase begins at launch and is to be completed within the first 60 days of the mission. The primary goals of this phase are to bring all spacecraft subsystems online, to validate their functionality, and to validate the interfaces with the instruments. As noted, successful completion of these items is required for delivery of the spacecraft to NASA by Spectrum Astro. In order to validate the instrument interfaces, the instruments themselves will also have to be brought online and will require the completion of all activities associated with certifying that the instruments are operational (e.g., instrument calibrations).

### *2.1.3 Normal Operations*

Normal operations will nominally begin at the conclusion of the 60-day on-orbit checkout period, and will encompass all activities necessary to collect and process science data and maintain the spacecraft, instruments, and ground systems on a routine basis. The normal operations phase is planned to terminate five years after launch, unless the mission life is extended to the stated goal of ten years.

## 2.2 OPERATIONS PRODUCTS

This section describes the various operations products that need to be developed and validated prior to launch in order to support the launch, early orbit, and normal operations phases. It also includes a discussion on the GLAST telemetry and command database, testing and operations simulations. The purpose is to establish a common understanding of the operations products and activities that are needed and their associated terminology so that the roles and responsibilities presented in Section 3 can be discussed in their context.

### *2.2.1 Ground System and Operations Configuration Control Board (CCB)*

The Ground System and Operations CCB will be responsible for the configuration control of all inter-element operational products (e.g. PROCS, Procedures, ICDs) until launch+60 at which time the Operations CCB will take control. The chair of the Ground System and Operations CCB is the Ground System and Operations Manager. All products that exceed the scope of the GLAST Ground System elements (i.e. the MSS) will be under the GLAST Project CCB.

The CCB will have representatives from the MOC, GSSC, LAT ISOC, GBM IOC, Spacecraft Manufacturer, Networks, SN and USN where applicable. The configuration management process is described in the *GLAST Ground System Configuration Management Plan.*

### *2.2.~~1~~2 Observatory Operations Plan*

The Observatory Plan describes how the observatory should be operated during the L&EO phase and during nominal operations from the observatory perspective. This is described via the *Flight Operations Plan* and the *Observatory Operations Description Manual*.

### *2.2.12.1 Flight Operations Plan (FOP) - CDRL 7*

The *Flight Operations Plan* is a high-level, textual description of how the spacecraft and instruments will be activated and brought on-line, and provides instruction as to how they should be operated in normal operations by the Flight Operations Team. Spectrum Astro delivers this plan as CRDL 7.

### *2.2.12.2 Observatory Operations Description Manual (OODM) - CDRL 5*

The *Observatory Operations Description Manual (OODM)* will provide a discussion of observatory operations concepts including contingency scenarios and procedures. It will include detailed information pertaining to the operation of observatory subsystems and their interfaces including operations with the ground element and contingency management.

CDRL 5 will contain the spacecraft and instrument (LAT and GBM) operations procedures in the format defined in the *GLAST Project Procedure/PROC Style Guide* and will be used for the development of the observatory PROCs. Spectrum Astro delivers this manual as CRDL 5.

### *2.2.23. Flight Operations Manual -(FOM)*

The *Flight Operations Manual* is a description from an operational perspective of how the observatory will be operated in the context of ground system capabilities and limitations, on-orbit communications limitations during nominal operations. This document also describes the operations procedures of the ground system itself. Examples of the latter include how the SSR will be managed and how the observatory will be prepared for each TDRS or ground station contact.

This plan is primarily derived from the Project's *Operations Concept Document* (OCD), which provides an overall operations description from the flight operations team perspective, the *Flight Operations Plan* (CDRL 7), the *Observatory Operations Description Manual* (CDRL 5) and is delivered by the Flight Operations Team.

The *Mission Operations Readiness Plan* (MORP) shall describe the plan, approach and schedule for how operations readiness will be achieved prior to launch from the FOT's perspective.

### *2.2.34 Operations Procedures*

Operations Procedures are detailed text descriptions and instructions for how to operate the observatory (spacecraft and instruments) and ground system, for both nominal and contingency situations and are used to develop the executable PROCS (section 2.2.7).

The procedures apply to the L&EO and normal operations phases and are written in the *GLAST Project Procedure/PROC Style Guide* format, which is provided by the FOT. The procedures will directly reference the appropriate PROCs as needed and include information such as:

procedure number, name, revision history, purpose, description, subsystem initial and final configuration, associated parent and child procedures, action and expected response.

The observatory operations procedures are defined in the *OODM* and are used by the FOT to develop the observatory operational PROCS.

The ground operations procedures are defined in the *FOM* and are used by the FOT to develop the ground system PROCS. The *MORP* shall describe the process for generation, validation and the configuration management of the various command procedures, and page displays.

### *2.2.44 L&EO Timeline*

The *L&EO Timeline* is derived primarily from the *Observatory Operations Description Manual* (CDRL 5). It provides a more detailed description of actions required (and when) to activate and checkout the spacecraft and instruments during the L&EO phase. It provides spacecraft and instrument events, activities, etc. across a multi-day timeline, expressed as a mission elapsed time from launch. It is thus somewhat independent of the exact launch date and time. It may contain placeholders for estimates for telemetry and command contacts and information on how they may be used, but these are only meant to assist in the more detailed planning that will be performed as exact launch dates and times are determined (i.e., they feed into the development of the L&EO Script, described in the next section).

This *L&EO Timeline* describes what needs to be accomplished on-board at a detailed level during the L&EO phase, and is a good vehicle for getting the big picture of what is going to be done over time (i.e., over multiple days).

### *2.2.56 L&EO Script*

The *L&EO Script* is a list of very specific activities that describes exactly what steps the operations team in the MOC should perform to accomplish the *L&EO Timeline*. The *L&EO Script* is dependent upon a specific launch date and time as the activities are expressed in absolute times. It includes items such as:

- any actions needed to configure the ground system
- any needed voice communications with remote sites
- information on what and when command PROCs or loads should be executed
- specific times (or time frames) for each step
- observatory contact times.

The *L&EO Script* is meant to be read by operations personnel, with copies typically available and used on-console in the MOC. It is thus not an executable.

### *2.2.67 Telemetry and Command (T&C) Handbook - CDRL 6*

The Telemetry and Command Handbook will describe the spacecraft bus, LAT, and GBM instrument telemetry and command features for launch and flight operations application. Spectrum Astro will provide the T&C Handbook as CDRL 6.

The telemetry portion of the T&C Handbook will contain all definitions and assignments necessary to decommutate all telemetry mnemonics within the database including, but not limited to, all calibration data, channel and packet information, and limits.

The command portion of the T&C Handbook will contain all definitions and assignments necessary to generate commands that can affect a response or change in the observatory configuration and their verification.

### *2.2.~~7~~8 Project Database (PDB)*

The GLAST project will be using a database compatible with ITOS version 7.2 and defined in the *Database ~~Date~~ ~~Data~~ Format Control Document (DFCD)* for the interchange of databases across the ground system elements. The ITOS system used in MOC operations requires that the telemetry and command (T&C) data be defined in a database. Physically, an ITOS database is a collection of ASCII-formatted flat files, whose format is defined in the ITOS User's Manual. On the GLAST Project, the ITOS format will be controlled by the ~~*Database*~~ *DFCD* to ensure changes to the database format are controlled and approved by the Project and therefore ensures that uniformity is maintained across all elements.

During spacecraft and instrument I&T, each site will have its own separate instantiation of the DFCD defined database ~~for~~ to support~~ing~~ testing being done at that site. For support of observatory I&T, these files will then be brought together into an overall Observatory T&C database. The Observatory T&C database will include definitions for all spacecraft and instrument telemetry and command data.

The MOC will use what is referred to as a Project Database (PDB). The PDB is the collection of telemetry, command, and ground system data definitions used by the MOC for all processing performed by ITOS. During the Pre-Launch Phase, the spacecraft and instrument telemetry and command definitions will be taken directly from the Observatory T&C database ~~-~~(all virtual channels or VCs). Definitions for ground system data, such as status data from ~~a~~ the ground station~~s~~, will be generated within the MOC by the FOT. Details on each organization's role in PDB generation are provided in Section 3.

The *MORP* will describe the process for generation, verification, post L&EO validation, and the configuration management of the Project Database.

### *2.2.~~8~~9 PROCs*

A PROC is an executable written in ASCII ITOS STOL language that is used to send commands and loads to the observatory, control ground functions, bring up display pages, etc. A sequence of PROCs would typically accomplish some on-board activity or function of the *L&EO Timeline*, such as bringing a subsystem online.

Each PROC tends to focus on one relatively small on-orbit action on a specific subsystem or instrument. They may contain some logic and branching. Operational PROCs (vs. I&T PROCs) tend to have waits after commands on associated telemetry verifiers (i.e., progression through commands in the PROC tends to be very deliberate).

The *MORP* shall describe the process for the generation, verification, validation and configuration managing of the various operations PROCs.

## 2.3 OPERATIONAL READINESS ACTIVITIES

### *2.3.1 Testing*

The GLAST ground system testing program will consist of a collection of tests that verify individual ground system element functionality and performance, internal and external interfaces, system operability, and end-to-end data flows. The roles of each of the ground system elements for each of the tests planned for the GLAST mission will be documented in the *Ground System Test Plan*. The *Ground System Test Plan* describes the series of tests that will demonstrate the Ground System's operational readiness to support the GLAST mission.

#### *2.3.1.1 Element Level*

Element Level Testing will verify functionality and performance of the individual elements that comprise the ground system and demonstrate element-to-element interface compatibility. Each of the elements will develop a *System Acceptance Test Plan* that will document the approach to testing each of the planned deliveries.

#### *2.3.1.2 RF Compatibility*

RF compatibility testing validates the ability of the spacecraft and ground system RF systems to communicate within agreed to specifications. It is comprised of a number of tests that verify all aspects of the RF interfaces and the forward and return links.

#### *2.3.1.3 Ground Readiness Testing (GRT)*

Ground Readiness Tests (GRTs) are designed to verify the interfaces, data flows, performance and major functionality of the GLAST ground system as a whole. This will be accomplished through a series of seven ground-system oriented tests using the simulators, simulated science or recorded observatory data.

The science tools and products validation will be performed via a series of Data Challenges. Successive Peer Reviews and collaboration with the science community will ensure products meet the science community needs.

#### *2.3.1.4 End-to-End (ETE) Tests*

The End-to-End tests are intended to verify the inter-operability between the MOC and the observatory. Only tests that involve the observatory and the MOC are considered ETE. The tests will be used to confirm that the FOT can operate the observatory using the capabilities provided by the MOC and that the operational concepts provided by the spacecraft vendor and instrument teams have been properly implemented by the FOT.

End-to-End tests will validate the observatory/ground system interface; serve to validate the end-to-end requirements that cannot be validated without the observatory; and, provide opportunities

to perform operations-oriented exercises with the observatory, particularly those that cannot be done adequately with the HotBench or Mission ~~Test~~ Training Simulator (MTS).

### *2.3.2 Simulations*

There are three types of operations simulations: L&EO, Normal, and Contingency Operations. L&EO Simulations (i.e., Sims) are rehearsals that exercise the L&EO Timeline and Script. Normal Operations Sims rehearse typical day-in-the-life scenarios once the observatory has been declared operational. Contingency Sims are rehearsals of various anomaly situations that may occur on-orbit, and augment the contingencies that may be integrated into the L&EO and Normal Ops Simulations. The *MORP* shall describe the plan for operations testing, simulations and rehearsals.

The general purpose of the simulations is to verify the readiness of the ”people, processes, and procedures” prior to launch. They thus also serve as an integral part of operations team training. When the Sims are conducted, it is assumed that the ground system and observatory capabilities and interfaces are already validated, which is accomplished via the Ground Readiness and End-to-End Tests. The simulations ~~will~~ may use a combination of the actual observatory, the HotBench ~~Simulator~~r, the Mission Training Simulator and NASA’s Portable Spacecraft Simulator (PSS), as appropriate.

The planned simulations will be documented in the *Simulation Plan*. This plan will define items such as the goals, objectives, configuration, schedules, dependencies, and success criteria for each simulation. Note that there will also be a variety of more informal operations exercises that will be used to prepare for the actual formal simulations.

# 3.0 ROLES AND RESPONSIBILITIES

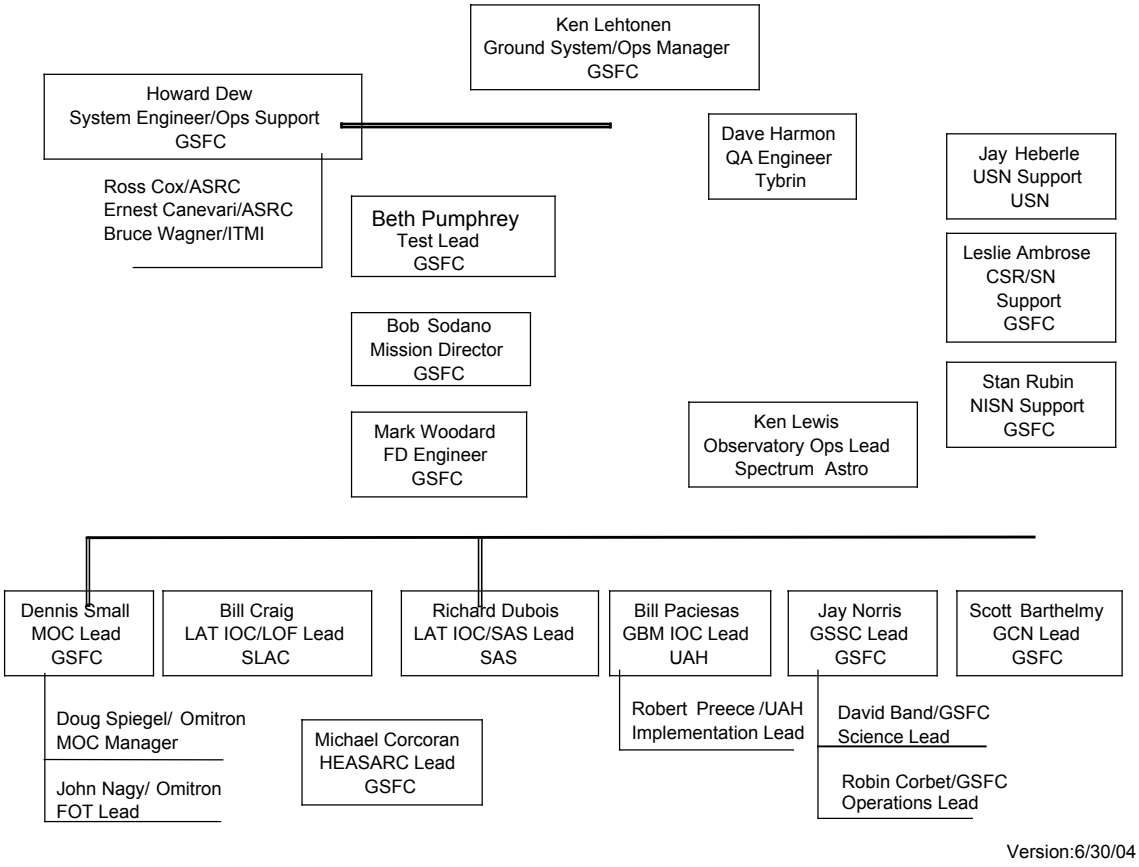
This section calls out the general and specific roles and responsibilities of each member of the GLAST Mission Operations Team. The roles are addressed for each of the mission phases: pre-launch, launch and early orbit (including instrument activation), and normal operations as described in Section 2.2. For each phase a diagram is provided that illustrates the members and organization of the Mission Operations Team. For the Pre-Launch Phase, the roles and responsibilities are also discussed in the context of the operations products described previously in that will have to be developed and tested prior to launch.

## 3.1 PRE-LAUNCH PHASE

### *3.1.1 Mission Operations Team Structure*

There are several organizations which will collectively work together to provide mission operations support. The approach to how they are organized is dependent upon the phase of the mission. In the Pre-Launch Phase, the team is organized as shown in Figure 3-1 below.

*Figure 3-1: Pre-Launch Phase Mission Operations Team*




During the Pre-Launch Phase, the NASA GLAST Project will take the lead role in planning, documenting, conducting, and reporting on activities directly related to ensuring that the operations team, products, and processes are ready for launch. Ultimate responsibility for

ensuring this launch readiness lies with Ground System/Operations Lead (GSOM). The GSOM has responsibility for the actual planning, coordination, and conducting of the activities required to achieve operations launch readiness. The GLAST Project Manager will provide support to the GSOM as needed to help resolve any significant issues related to funding, team member participation, critical aspects of the operations plan, disagreement among team members, etc.

Other members of the operations team will directly support the GSOM in all pre-launch readiness activities. This includes supporting the creation and review of pre-launch operations documentation (e.g., the Simulation Plan), planning and debriefing meetings, the creation of needed operations products (e.g., command PROCs), and the conduct of the actual simulation activities.

NASA's role in operations will vary depending on the phases of the mission. NASA is responsible for the GLAST mission and thus has overall decision authority and program responsibility.

### *2.2.1 Ground System and Operations Configuration Control Board (CCB)*

The Ground System and Operations CCB will be responsible for the configuration control of all inter-element operational products (e.g. PROCS, Procedures, ICDs). The chair of the Ground System and Operations CCB is the Ground System and Operations Manager. All products that exceed the scope of the GLAST Ground System elements (i.e. the MSS) will be under the GLAST Project CCB.

The CCB will have representatives from the MOC, GSSC, LAT ISOC, GBM IOC, Spacecraft Manufacturer, Networks, SN and USN where applicable. The configuration management process is described in the *GLAST Ground System Configuration Management Plan.*

### *3.1.2 Observatory Operations Plan*

Spectrum has lead responsibility to ensure that the *Flight Operations Plan (CDRL 7)* and *Observatory Operations Description Manual (CDRL 5)* are created, and that they are appropriate, accurate and complete for getting the spacecraft on-orbit.

The LAT and GBM IOTs are responsible for providing the instrument-specific information to Spectrum for incorporation into these documents. The IOTs are thus responsible for the contents of the instrument portions of these documents.

The FOT and NASA will provide any needed input related to ground system capabilities, limitations, or preferences. The FOT and NASA will also provide general support in reviewing and providing comments on the documents.

### *3.1.3 Flight Operations Manual (FOM)*

The FOT has lead responsibility for creating the *Flight Operations Manual*. The *FOM* establishes the role of the ground system within the overall observatory operations and is

oriented towards how the FOT should use the ground system to support spacecraft and instrument operations. The *Mission Operations Readiness Plan* details how the FOT will develop and validate the ground system products described in the *FOM*.

Spectrum and the IOTs shall provide the FOT with the necessary spacecraft and instrument information, respectively, and shall also provide detailed review support.

NASA will provide general oversight, review and comment support.

### *3.1.4 Operations Procedures*

Since the *Operations Procedures* are a collection of documents that cover the spacecraft, instruments, and ground system, responsibility for generating them is distributed.

Spectrum is responsible for generating all *Operations Procedures* that relate directly to operating a spacecraft subsystem, as well as any instrument procedures that involve direct interaction between the spacecraft and instrument (i.e., require control of the instrument via spacecraft commands). Spectrum will provide support for *Operations Procedure*s generated by the IOTs and FOT as well.

All other instrument *Operations Procedures* are the responsibility of the LAT and GBM IOTs respectively and shall be delivered to Spectrum for inclusion in the OODM.

The FOT is responsible for any *Operations Procedures* directly related to normal day-to-day observatory operations (i.e., for those areas where there is operational flexibility on how to operate the spacecraft or instrument, such as management of the SSR). They are also responsible for any that apply to the use and operation of the ground system. . The IOTs shall support the FOT by providing any relevant instrument information and expertise

#### *3.1.4.1 Procedure Configuration Management (CM)*

All members of the Mission Operations Team (MOT) (i.e., Spectrum, IOTs, FOT, GSSC and NASA) shall support the operations product configuration management process. The GSOM shall lead this process (i.e., chair the Ground System and Operations CCB).

Due to the developmental nature of Procedures during the Pre-Launch phase the operations teams may provide updates to the Procedures outside of the formal *OODM* or *FOM* deliveries. Procedures that have not yet been officially received via a deliverable document will not be under Operations CCB control unless they are to be used for testing with the observatory or during an official ground test.

If changes to the Procedures are required prior to the delivery of the OODM or FOM, they will be referred to the CCB board for approval. Once the board has approved the Procedure change request, the Procedure may then be utilized in the modified form for PROC development. The subsequent delivery of the OODM or FOM shall then contain the approved changes. This will minimize document delivery overhead, maintain CM control for operational products and not artificially delay product development.

### *3.1.5 L&EO Timeline*

Spectrum has lead responsibility to ensure that the *L&EO Timeline is* created, and that it is appropriate, accurate and complete for getting the spacecraft on-orbit.

The LAT and GBM IOTs are responsible for providing the instrument-specific activation and checkout information to Spectrum for incorporation into this document. The IOTs are thus responsible for the contents of the instrument portions of these documents.

The FOT and NASA will provide any needed input related to ground system capabilities, limitations, or preferences. The FOT and NASA will also provide general support in reviewing and providing comments on the document.

### *3.1.6 L&EO Script*

The FOT (Goldbelt Orca/Omitron) shall take the lead role in putting together the complete *L&EO Script* based on the *L&EO Timeline*. Since the *L&EO Script* addresses the spacecraft, instrument, and ground operations activities during the L&EO phase, and since the FOT is assuming operations responsibilities after the L&EO phase, it is appropriate for the FOT to assume this responsibility.

Spectrum is responsible for providing and approving all information related to activation and checkout of the spacecraft and the spacecraft interfaces to the instruments.

The Instrument Teams are responsible for providing and approving all information related to activation and checkout of the instruments.

The FOT is responsible for providing support in areas related to the ground system, e.g., contact planning/scheduling and ground system capabilities analysis. The appropriate NASA GLAST Project, Spectrum Astro, FOT, and Instrument Team personnel must approve the L&EO Script.

### *3.1.7 PROCs*

The FOT will be responsible for developing and validating all of the PROCs needed for all mission phases of spacecraft operations from the MOC. PROCs will be developed based on the procedures provide by Spectrum Astro for the spacecraft/observatory and the LAT and GBM IOTs for the respective instruments and ground operations procedures provide by the FOT.

The FOT will develop the PROCs consistent with the guidelines established in the *GLAST Project Procedure/PROC Style Guide*. Spectrum and the Instrument Teams shall provide review support, and will have to approve any PROCs that are needed during the Pre-launch and L&EO phase.

Spectrum will assist in the validation of the FOT-generated PROCs through peer reviews and participation in simulations, rehearsals, exercises and end-to-end testing. In addition, Spectrum will be responsible for signing off on all PROCs and ensuring they have been properly validated prior to being sent to the FOT. Spectrum may provide the FOT with I&T PROCs that may be re-useable for operations once translated into the ITOS STOL language. However, the FOT will be

responsible for providing spacecraft and instrument PROC review support during the I&T PROC development and testing process, and for making the PROCs operational.

For instrument PROCs, the instrument teams will be responsible for providing the FOT with procedures from which the FOT will generate the operational PROCs. The Instrument teams are responsible for signing off and assisting in the validation of all instrument PROCs.

### *3.1.7.1 PROC Validation*

All PROCs to be used in operations must be validated prior to launch, where "validated" means that they have been rigorously tested with the HotBench or spacecraft as required and are deemed ready for operational use, and therefore can be used with the observatory. The requirements for PROC validation fall into three categories based on the criticality of the PROC:

- PROCs that cannot be sufficiently validated against the HotBench, due to the lack of fidelity of the simulator, will be validated against the observatory. This will be done when validating the PROC does not pose a risk to the observatory. These PROCs must be run on the MOC system located at GSFC (during I&T). The expectation is that this represents a relatively small percentage of the total collection of PROCs.
- The majority of PROCs are expected to be validated against the HotBench and instrument simulators only. This is dependent on the criticality of the PROC and the fidelity of the simulator in use. They must be executed from the MOC located at GSFC for final validation.
- Ground System PROCs (e.g., those used to configure the MOC systems) can be validated against any of the simulators of appropriate fidelity.

For all PROCs that require validation on the MOC system, the FOT will be responsible for executing the PROCs and validating that they are running properly on the MOC system (i.e., that they are performing the same functionality in the MOC as the equivalent PROCs were in I&T). Spectrum shall determine for each spacecraft PROC if the HotBench Simulator, the observatory, or a combination of the two, is appropriate for validation. Ultimate and final determination that a spacecraft PROC running in the MOC is achieving the desired results with the spacecraft is the responsibility of Spectrum. As noted above, validation of spacecraft-related PROCs developed by the FOT are subject to the approval of Spectrum, but the FOT is ultimately responsible for generating all of the appropriate PROCs.

For instrument PROCs, the ~~Instrument Operations~~IOTs and science ~~Teams~~ teams ~~(IOTs)~~ shall provide the same type of support to the FOT as described above for Spectrum. Ultimate and final determination that a PROC running in the MOC is achieving the desired results with the instrument is the responsibility of the IOTs. The FOT is responsible for generating the PROCs and validating that they execute properly on the MOC system, but the IOTs are responsible for validating that the desired instrument results are achieved and approving all instrument PROCs for operations.

### *3.1.7.2 PROC Configuration Management (CM)*

The FOT is responsible for providing the system and infrastructure within the MOC to support configuration management and control of operational PROCs and other operations products in general.

All members of the Mission Operations Team (i.e., Spectrum, IOTs, FOT, GSSC and NASA) shall support the operations product configuration management process. The GSOM shall lead this process (i.e., chair the Ground System and Operations CCB).

Due to the developmental nature of Procedures during the Pre-Launch phase, not all the PROCs that may be needed will be developed directly from the *OODM* and *FOM* Procedures. However, all PROCs that are to be used during observatory or ground system testing must be under CM control. Once under CM control all PROCs will require Operations CCB approval in order to be modified. Changes to the PROCs will also require that appropriate changes be made to the relevant procedures.

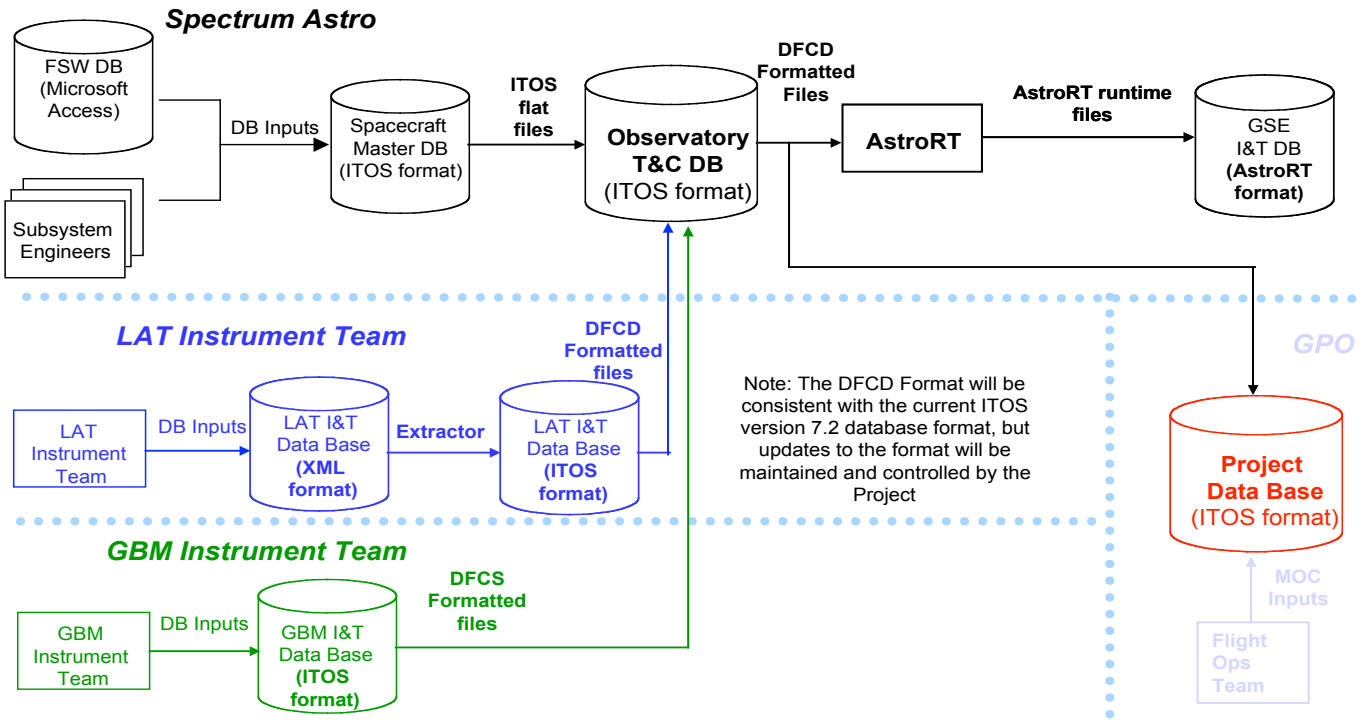
### *3.1.8 Telemetry and Command (T&C) Handbook - CDRL 6*

The *T&C Handbook* will be delivered by Spectrum Astro as CDRL 6.

The IOTs will provide review support to ensure that the instrument content portion of the T&C Handbook accurately reflects their respective instruments telemetry and command definitions.

FOT will provide review support to ensure that the information contained in the T&C Handbook is properly understood.

### *3.1.9 Project Database (PDB)*



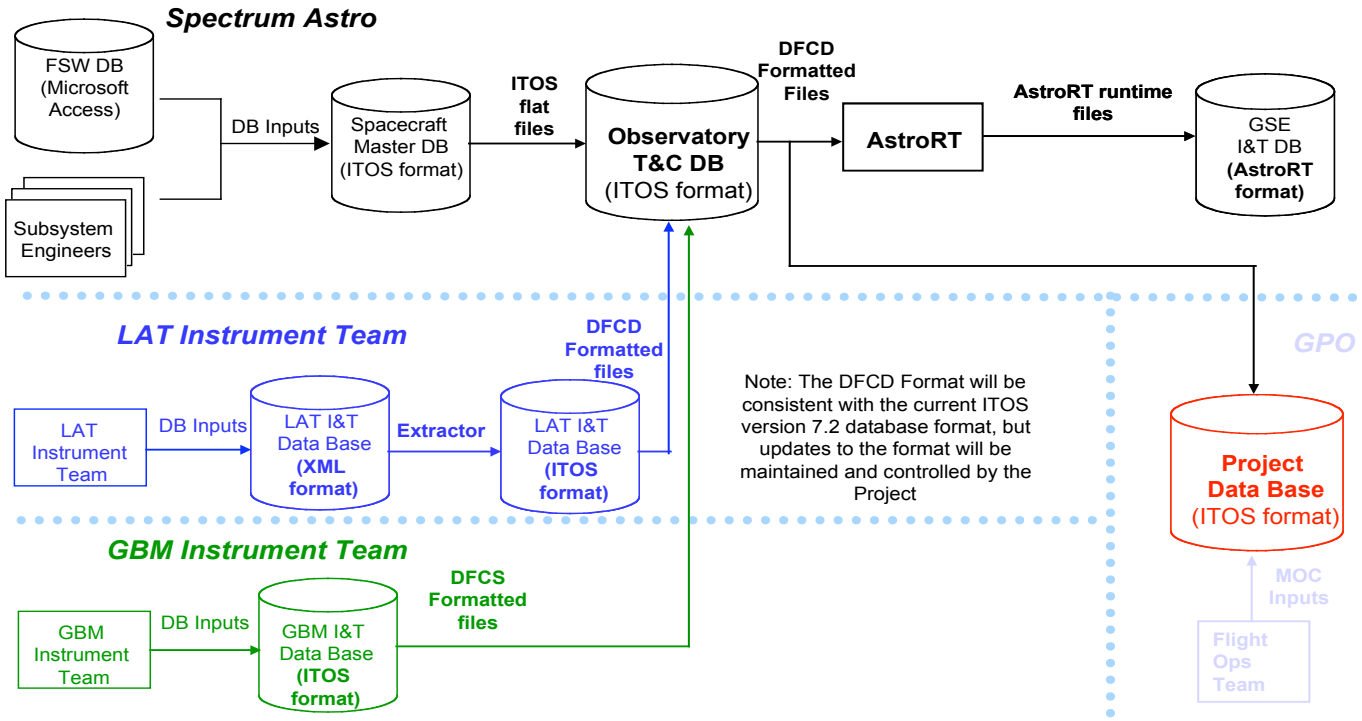



*Figure 3-2: Pre-Launch Project Data Base Flow*

*The flow of DFCD defined database files among the various GLAST organizations is depicted in Figure 3-2 above.*

Spectrum Astro is responsible for periodically delivering the Observatory Telemetry and Command Database to the FOT in the ~~*Database*~~ *DFCD*-defined format, which is controlled by the Project CCB. The Observatory T and C Database will include the inputs from the LAT and GBM instrument teams. The instrument teams will provide complete databases in the DFCD format to Spectrum at pre-defined intervals. The FOT in turn will add ground related inputs the observatory T&C database to form the PDB.

Spectrum Astro is responsible for the validation of the Observatory T&C Database by ensuring that all commands give the expected end item response and that telemetry provides the expected value. It is expected that all commands and telemetry will be validated against the observatory where possible and the HotBench when ground testing against the observatory would provide significant risk. The instrument teams will perform validation of their respective databases prior to delivery to Spectrum, at which time Spectrum will perform the overall validation. Spectrum is responsible for ensuring the completeness and appropriateness of the files related to the spacecraft. Likewise, the individual instrument teams are responsible for the content of the instrument portion of this observatory I&T database that is delivered to the FOT by Spectrum.

The FOT in turn will verify that the DFCD formatted database provides the same command bit patterns and telemetry values as the database used in Observatory I&T (i.e., the I&T DB and the PDB provide identical command and telemetry values). Spectrum Astro will provide support in generating commands and telemetry responses and capturing the data for comparison of the I&T and PDB databases.

Updates to the T&C portion of the PDB between Observatory T&C "drops" from Spectrum, may be performed by the FOT if Spectrum provides validation of the end item result and authorization prior to use against the observatory. This shall include HotBench validation prior to execution against the observatory. Otherwise, all T&C updates to the PDB prior to launch will be provided by Spectrum.

All formal Observatory T&C Database deliveries from Spectrum will be planned on the Project Schedule and will be scheduled approximately every six months to coincide with major observatory and test milestones. The formal database drops will include the database version number (including LAT and GBM database versions) in accordance with the conventions established in the *Database DFCD.* The delivery will also include information such as: all database changes, current validation list, record of discrepancy closures delivered with database release, and known database deficiencies.

Spectrum Astro will deliver Observatory T&C databases at Spacecraft Critical Design Review (CDR), the start and end of spacecraft I&T, the start and end of Observatory I&T, at the end of Thermal Vacuum (TVAC) Testing, and post launch (all deliveries are TBR). In addition, periodic formal drops will be made to coincide with MOC releases. These deliveries will be made at approximately 6 weeks prior to the scheduled MOC release. In the event that a MOC and spacecraft milestone deliverable coincides within a two-week period (TBR), the T&C database deliveries will be combined.

#### *3.1.9.1 Project Database (PDB) Configuration Management (CM)*

The FOT may request informal deliveries (database snapshots) of the Observatory T&C Database from Spectrum, but the request must be made at least two weeks prior to the requested delivery date and will not include the overhead associated with formal deliveries. Informal deliveries will be designated with an incremental version number form the last formal release (e.g., the first informal delivery after a formal delivery would be version 1).

All observatory testing (e.g., end-to-end tests) will be performed using formal database deliveries from Spectrum including the instrument portion of the database. In the event the MOC is using an informal delivery for development purposes, the MOC will revert to the latest formal drop prior to executing a test with the observatory.

The FOT is responsible for pulling together the collection of various ITOS databases and associated flat files to form the PDB to be used in the MOC. The PDB will thus contain all definitions needed by the ITOS systems running in the MOC for operations support. Again, for the spacecraft and instrument definitions, Spectrum and the instrument teams retain responsibility for the content of all spacecraft and instrument-related ITOS files in the PDB, respectively.

The FOT will provide the appropriate MOC configuration control over the PDB and its associated files to ensure that the proper set of files are used for test and operations activities.

The FOT is responsible for delivering the PDB (DFCD-defined format) to the GLAST Science Support Center (GSSC), Spectrum Astro and to the LAT and GBM IOCs as needed. The GSSC will use the PDB to interpret IOT command requests and generate the science timeline. The FOT shall also deliver the PDB files to the Portable Spacecraft Simulator (PSS) (not shown in Figure 3-2) to be used for ground system and operations test support.

Spectrum's responsibility to deliver the Observatory T&C database ends at launch +60 at which time the FOT will assume responsibility for the maintenance of the T&C portion of the database as well as the ground segment.

### *3.1.10 Ground System Testing*

The Ground System/Operations Manager (GSOM), has overall responsibility for ensuring that the ground system requirements, interfaces, and design are developed and documented, and is ready to support GLAST launch by the launch freeze date.

The Project's Systems Engineering Team will work with the ground/ops team to make sure that the end-to-end MSS(??) requirement verification needs are covered in the GRTs or ETEs.

The FOT (Goldbelt Orca/Omitron) is responsible for providing the physical MOC infrastructure (facility and systems) to support pre-launch operations activities and on-orbit observatory operations, as well as the personnel (FOT) to operate the ground system. The FOT shall play a lead role in activities related to ground system coordination, scheduling, and troubleshooting.

The IOTs are a collection of organizations that will design, build and operate the IOCs (hardware and software), namely the LAT ISOC (LISOC) and GBM IOC (GIOC). Their role on the Mission Operations Team relative to the instruments is thus comparable to Spectrum's role as spacecraft contractor.

The GSSC will participate in Ground Readiness Testing and simulations as required to ensure operational readiness and compatibility with the MOC, Instrument Operations Centers (IOCs), HEASARC and the science community.

#### *3.1.10.1 RF Compatibility Testing*

~~The FOT will provide MOC workstations to monitor telemetry.~~
~~NEED ADDITONAL WORDS HERE……~~
~~Spectrum will provide observatory schedule and technical support.~~
RF Compatibility testing validates the ability of the spacecraft and ground system RF systems to communicate and will be comprised of 4 tests (5 days in length) that verify all aspects of the RF interfaces and forward and return links. These tests will assess the spacecraft RF interface compatibility with the TDRS and USN by measuring the telemetry values at the ground station's receivers and verifying the spacecraft command receiver operations.

All RF compatibility testing will be conducted while the spacecraft is in the spacecraft contractor facility (Gilbert, AZ). Spectrum will provide observatory schedule and technical support. For TDRSS, CTV may also send data to GSFC MOC via TDRS/WSC and to MOC workstations (approx. 2) support at Spectrum may also receive data. The MOC workstations will be for FOT monitoring purposes only and will not be integral to the testing performed by Spectrum Astro.

For TDRSS Compatibility Test Van (CTV) support at Spectrum Astro the Simulations Operations Center (SOC) at GSFC and the Compatibility Test Van (CTV) will be used to communicate with TDRS and the Space Network's (SN) Demand Access System (DAS), at the White Sands Complex (WSC). KU-Band data may be sent to the MOC via the GFEP at WSC.

For USN RF Compatibility Testing, USN will provide an RF suitcase that will simulate the Commercial Ground Stations. The RF Suitcase will receive data from the RF transceiver on the spacecraft and process it in accordance with the signed ICD. The data may be transmitted to the the MOC via the TCP/IP port on the back end of the RF Suitcase

### *3.1.10.2 Ground Readiness Tests (GRTs)*

The FOT will lead testing in terms of determining what activities can and should be performed with the Ground System. The FOT is responsible for planning, documenting (e.g., test scripts), and coordinating execution of the test. The FOT will also generate briefing and debriefing messages.

The GSSC (including HEASARC and GCN), LAT and GBM Instrument Teams, SN and ground stations will be responsible for providing test and operational support. This will include input to test objectives, script review, and development of products (PROCs and loads) for test support.

The LAT and GBM IOCs will be responsible for the validation of their respective science tools and products. Validation will be performed via a series of Data Challenges. Data from the Data Challenges will be used to validate GSRD science data requirements during the GRTs. Successive Peer Reviews and collaboration with GSSC will ensure that products meet the science community needs.

### *3.1.10.3 End-To-End (ETE) Tests*

The Test Plan represents the agreement on the scope of testing for each test as well as approach to achieving test objectives. The Ground System Test Lead coordinates the tests and provides NASA oversight. This includes the determination of test objectives, approval of test resources and oversight during test execution. The Ground System Test Lead will ensure briefing and debriefing messages are generated for each of the tests.

Spectrum Astro will lead testing in terms of approving which activities can and should be performed with the observatory. They will provide personnel at the I&T facility to support testing and to ensure observatory health and safety. Spectrum will have the authority to abort the test and resume control in the event observatory health and safety is jeopardized. In addition, Spectrum will provide the official T&C database to be incorporated into the Project Database for each End-to-End Test.

Spectrum shall also provide the FOT with opportunities to become familiar with the spacecraft design and associated operations products, via methods such as training, participation in the product review process and spacecraft testing.

Spectrum in conjunction with the FOT and IOTs will participate in the review of test scripts and the approval of all products generated by the FOT and IOTs to be used during the test. For example, the decision as to which PROCs should be run against the spacecraft, signing off on PROCs before they are used in the test and review of the test script.

Spectrum's primary responsibilities during test execution will include: observatory setup (i.e., placing the observatory in the expected test configuration), maintaining observatory health and safety during testing, and safing the observatory prior to the conclusion of the test. Test support will be provided through the Observatory Operations Lead, who will act as the liaison between Spectrum and the Ground System Team for ETE Testing.

The FOT is responsible for developing the test products, verifying products against the simulators, validation of PROCs, planning and documenting (e.g., test scripts) the test, ensuring the ground system components are ready to support the test objectives and executing the test from the MOC. The FOT is also responsible for ensuring that they take advantage of the appropriate documentation and any training opportunities provided by Spectrum and the instrument teams so as to become very familiar with the spacecraft and instrument designs and the associated operations products, respectively.

The instrument teams are responsible for supporting their respective instruments during testing and will provide support through the IOC Leads. The IOTs in conjunction with the FOT and Spectrum will determine the instrument configuration and interfaces required to meet the objectives of the test. The IOTs will approve all operational products to be used with the instruments including all loads, PROCs and the scripts to ensure the instrument is properly operated and provide operational products as required to meet the test objectives.

The IOTs will provide personnel at the Spectrum I&T Facility whenever their respective instruments are powered on and at the MOC whenever instrument commands are being executed from the MOC. The IOCs will monitor instrument operations and provide operational expertise in direct support of Spectrum's role in doing this for the observatory as a whole. The Instrument Operations and science Teams (i.e., LAT and GBM IOTs) are responsible for providing the FOT and GSSC with opportunities to become familiar with the instrument design and associated operations products, via training, participation in the product review process and instrument testing.

### *3.1.11 Simulations*

NASA will provide lead support in planning, documenting, and conducting all Operations Simulations needed prior to launch. This support will be provided primarily by the GSOM. NASA will ensure that the collection of simulation activities prior to launch ensure the overall launch readiness of the operations staff, products, and processes. . During the simulation activities, the operations team members will generally assume the roles they will play during the L&EO and Normal Operations phases, as described in subsequent sections of this Agreement.

The GSOM will thus play the role of overall coordinator and facilitator, where the actual simulation activities (e.g., rehearsals) will be performed by the operations team that will be in place during all phases of the mission.

Spectrum is generally responsible for determining what type of simulation activities are needed to ensure successful spacecraft activation and checkout during the L&EO phase. They must also provide direct support for the planning, documentation, conduct, and evaluation of the actual simulations.

Spectrum is responsible for participating in the various operations activities that will ensure that they are capable of adequately using the MOC real-time processing system (i.e., ITOS) for L&EO support. This would include for example, the ability to bring up display pages and run PROCs.

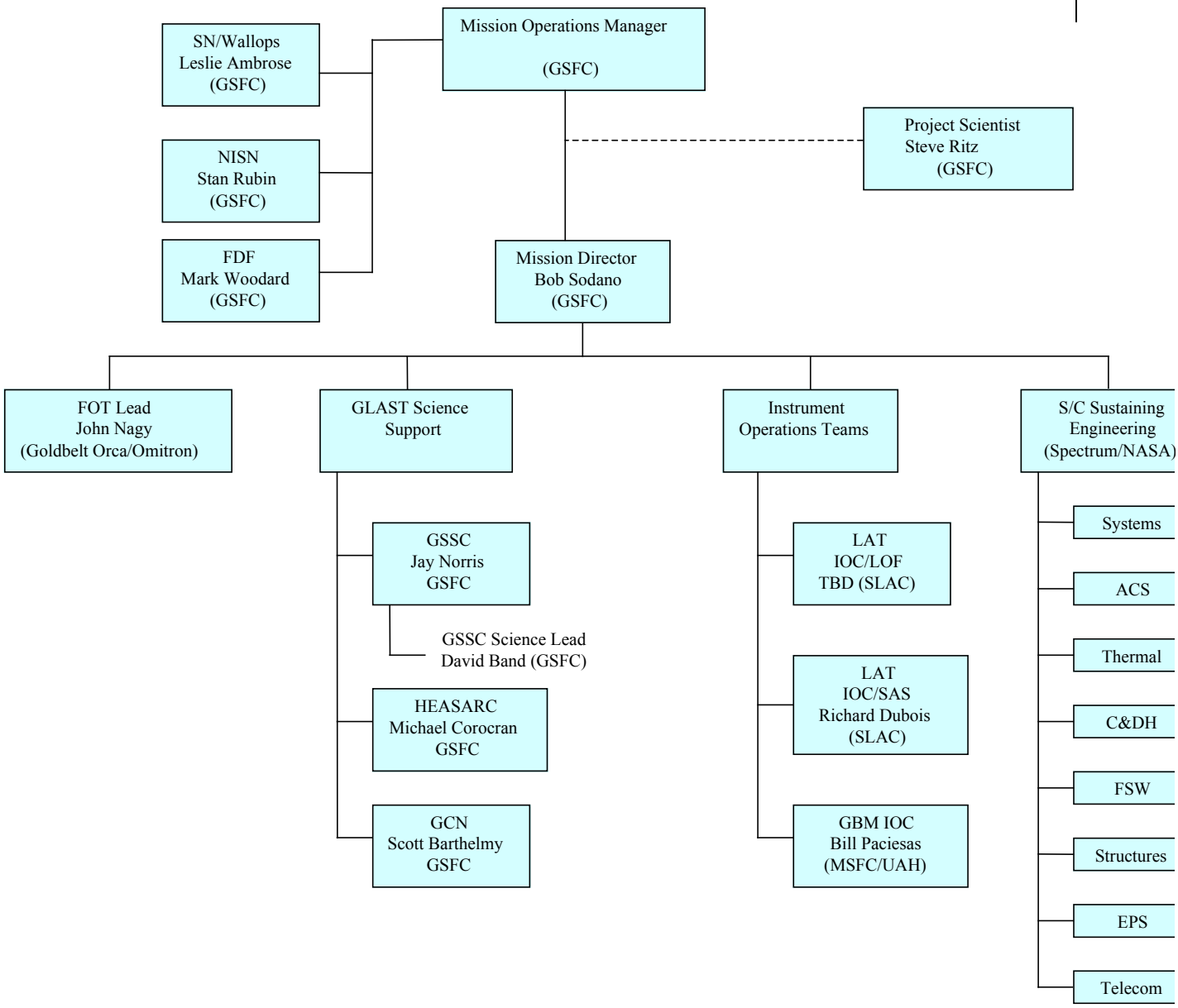
The FOT is generally responsible for determining what type of simulation activities are needed for the Normal Operations Phase. They must also provide direct support for the planning, documentation, conduct, and evaluation of the actual Simulations. The FOT is responsible for providing the necessary MOC training to Spectrum and the IOTs and ensuring that they have adequate opportunities to learn how to use the system.

The Instrument Teams are responsible for supporting all simulation activities that relate to the instruments. This includes attending planning meetings, reviewing documentation, providing needed simulation information and products, participating in the actual simulation, and supporting all simulation debrief activities.

## 3.2 LAUNCH AND EARLY ORBIT PHASE

### *3.2.1 Mission Operations Team Structure*

As described earlier, there are several organizations which will collectively work together to provide mission operations support. The approach to how they are organized is dependent upon the phase of the mission. In the L&EO Phase, the team is organized as shown in Figure 3-4 below. Update diagram.



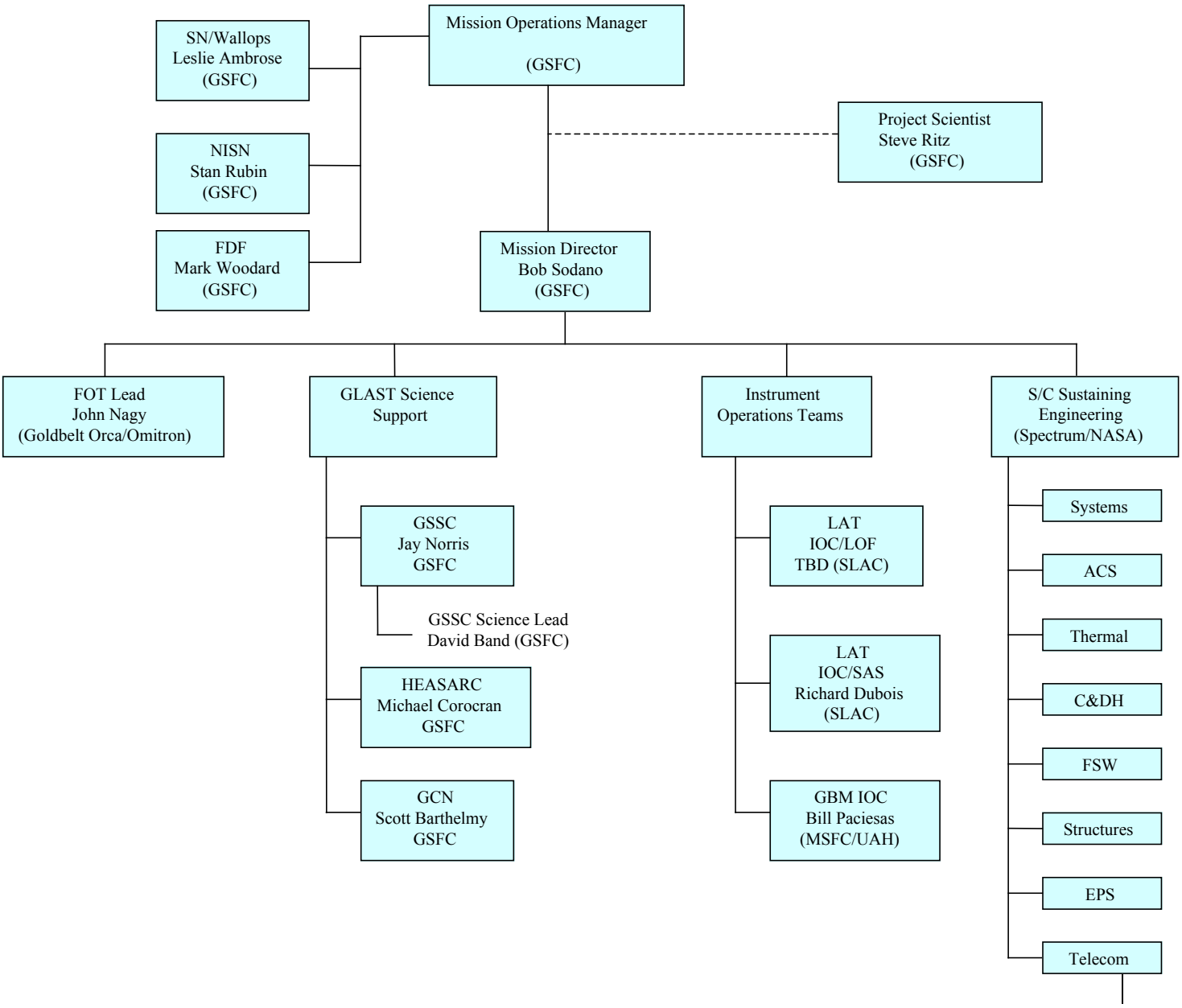



*Figure 3-4: Launch and Early Orbit Phase Mission Operations Team*

The GLAST Project Manager will review L&EO documentation/plans, resolve any conflicts between instrument and spacecraft activation, and accept delivery of the spacecraft. The Project Manager will work directly with the GLAST PI in making critical operations decisions, particularly when they involve the instruments.

The L&EO Director (LD) will be responsible for activating the spacecraft, verifying its operations, maintaining safety of all payload elements, and delivering the spacecraft to NASA when done. This person has day-to-day operational authority during the L&EO Phase. The LD approves deviations from the pre-planned sequence of activation and checkout. The L&EO Director will be provided by Spectrum and will generally be the lead in all aspects of mission operations during the L&EO Phase. The LD will utilize a support team with representatives from each of the organizations that comprise the Mission Operations Team. These include the

instruments, ground system, and spacecraft areas. The LD will have the authority to give direction to the supporting element personnel as needed to ensure that overall operations support is provided.

The support elements generally are responsible for giving the LD a single point of contact to work issues within that element, such as for a particular instrument or ground system component. Each support element lead is responsible for ensuring that issues within that element are worked to the satisfaction of the LD.

The MOC Director, MOC Operations Lead, and FOT are responsible for providing operations support in the MOC. This includes staffing consoles for monitoring observatory health and safety, and performing all needed ground system scheduling/planning and observatory commanding. This support will provide good opportunities for the FOT to further prepare for taking over operations responsibility after the L&EO Phase.

Spectrum is responsible for providing the LD with the needed spacecraft engineering support for evaluating subsystem performance, investigating anomalies, etc. The Instrument Teams shall provide the same type of support for their respective instruments.

The GSOM shall ensure that the needed operations support from the ground system outside of the MOC is provided as needed, to especially include leading any troubleshooting activities with non-MOC portions of the ground system.

Given that Spectrum is responsible for delivering the spacecraft on-orbit to NASA (within a L+60 day time frame), Spectrum will generally take a lead role in ensuring the appropriateness and readiness of the operations products directly related to L&EO spacecraft support.

### *2.2.1 Ground System and Operations Configuration Control Board (CCB)*

The Ground System and Operations CCB will be responsible for the configuration control of all inter- ground element operational products (e.g. PROCS, Procedures, ICDs). The chair of the Ground System and Operations CCB is the Ground System and Operations Manager. During the L&EO phase, the Mission Director will become part of the CCB process and will co-chair with the GSOM. All products that exceed the scope of the GLAST Ground System elements (i.e. the MSS) will be under the GLAST Project CCB.

The CCB will have representatives from the MOC, GSSC, LAT ISOC, GBM IOC, Spacecraft Manufacturer, Networks, SN and USN where applicable. The configuration management process is described in the *GLAST Ground System Configuration Management Plan.*

### *3.2.2 Operations Procedures*

During the L&EO phase, the *Operations Procedures* will follow the same process as during the Pre-Launch Phase.

### *3.2.3 L&EO Timeline*

#### *3.2.3.1 Scheduling* ***ALL OF THESE NEED "HELP"***

The L&EO timeline will be modified within the MOC until the activation activities on the L&EO timeline have been completed.
The IOTs will provide all scheduling updates to the FOT via the GSSC once the science timelines originate from the IOC facilities. The GSSC will act as a bent pipe during the L&EO phase and will provide no vetting of the science time line during this period.

### *3.2.4 L&EO Script*

#### *3.2.4.1 Scheduling*

The L&EO script will be maintained by the FOT during the L&EO period. All change requests from Spectrum Astro and the IOTs will provide schedule inputs directly the FOT in the MOC during activation and checkout. The IOTs shall provide the science timelines through the GSSC as a bent pipe once activation and checkout is completed.

### *3.2.5 Project Database (PDB)*

During the L&EO phase, the PDB will follow the same process as during the Pre-Launch Phase.

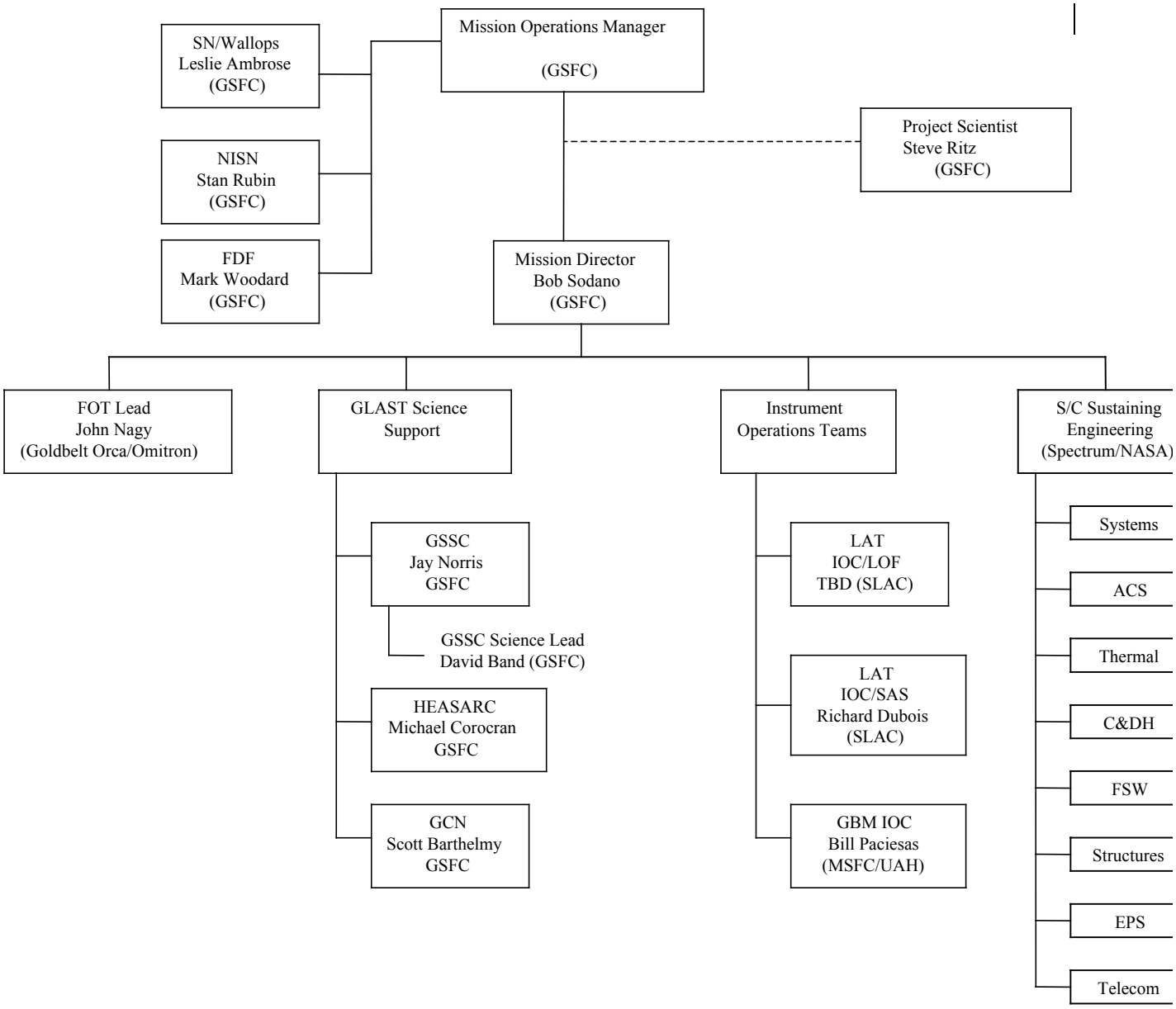
### *3.2.6 PROCs*

During the L&EO phase, the PROCs will follow the same process as during Pre-Launch.

## 3.3 NORMAL OPERATIONS PHASE

### *3.3.1 Mission Operations Team Structure*

As described earlier, there are several organizations which will collectively work together to provide mission operations support. The approach to how they are organized is dependent upon the phase of the mission. In the Normal Operations Phase, the team is organized as shown in Figure 3-5 below.



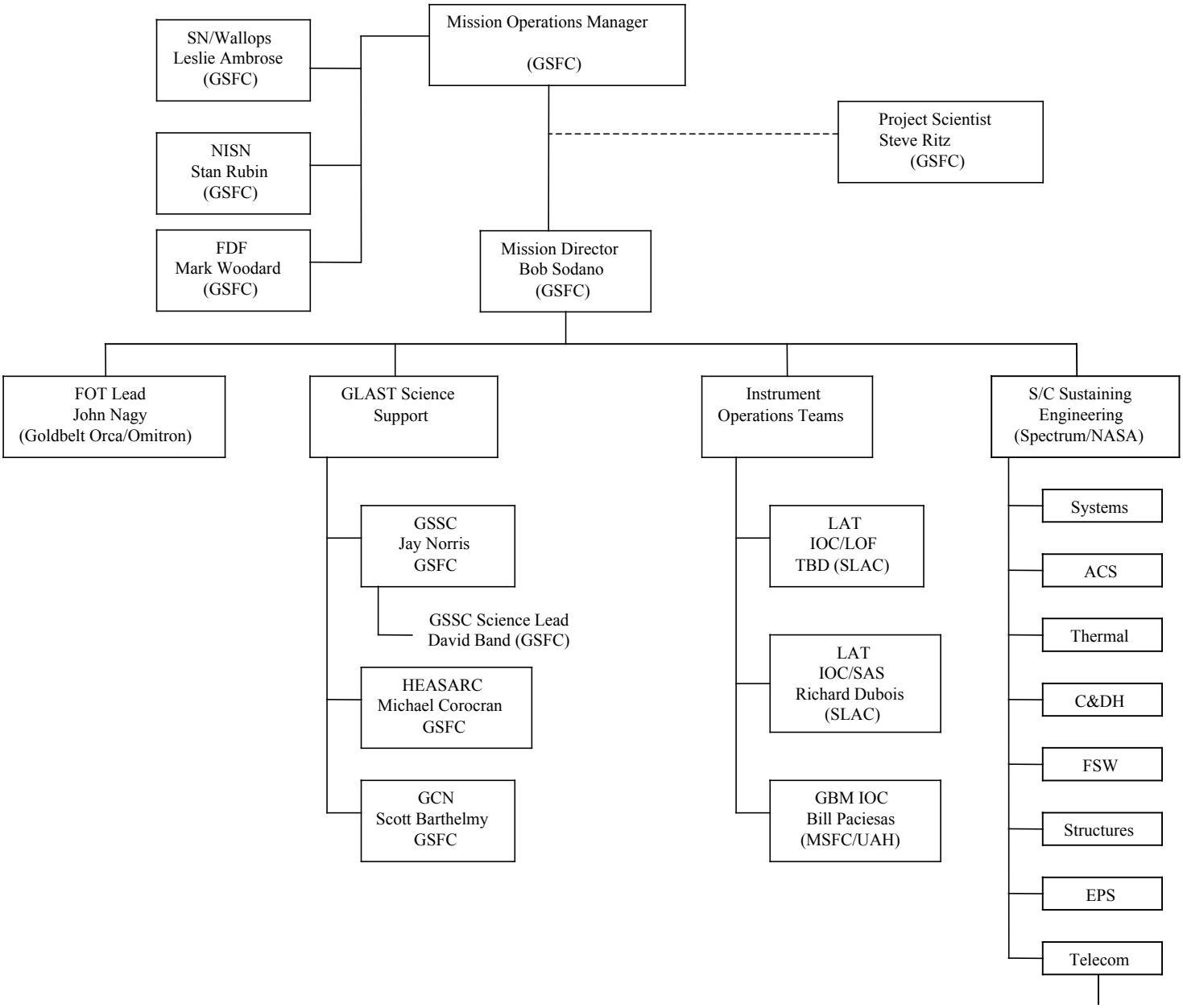



*Figure 3-5: Normal Operations Phase Mission Operations Team*

At the conclusion of the L&EO Phase (and delivery of the spacecraft to NASA), responsibility for observatory operations shifts from Spectrum to the FOT. The L&EO Director role is replaced by a Mission Director (MD). The MD is provided by NASA and has full mission (science and flight) operations responsibility and authority.

The Mission Director will work closely with a NASA-provided Mission Operations Manager (MOM). This will provide the Space Science Operations office at GSFC with the necessary insight into GLAST operations status, planning, etc., and will provide the Mission Director with a NASA point of contact to work significant ground system issues outside of the MOC. The NASA MOM will also provide the Mission Director with ready access to spacecraft engineering expertise at NASA if needed.

The FOT will be responsible for the operation of the spacecraft on a day-to-day basis, to include items such as planning and scheduling spacecraft activities, managing the dump and subsequent processing of on-board recorded data, and monitoring spacecraft and instrument real-time housekeeping data. The FOT is also responsible for analyzing spacecraft subsystem performance (i.e., short and long term trending).

The IOTs are responsible for planning instrument operations and making these plans available to the GSSC for science observation validation. The FOT will incorporate the consolidated science timeline into the overall observatory plan. The IOTs are also responsible for performing instrument performance and anomaly analysis. The Science Operations Team (SOT) will utilize support from the appropriate ~~Instrument~~ instrument ~~Teams~~ teams (i.e., the instrument developers) for analyzing instrument performance and anomalies as needed. The instrument ~~Teams~~ teams will provide any needed changes to instrument on-board tables or software to the SOT, who will in turn provide these products to the FOT for uplink.

Spectrum will ideally be providing spacecraft sustaining engineering support for all spacecraft subsystems, including flight software, but this is subject to contract negotiations with NASA. Whether provided by Spectrum or another organization, the FOT will rely on spacecraft sustaining engineering support for areas such as in-depth analysis of anomalies and long-term performance.

The GLAST Science Support Center (GSSC) is responsible for providing the interface between the GLAST mission and the scientific community. This will be accomplished by providing instrument commands from the IOCs to the MOC and providing science data to the user community.

### *3.3.2 Operations CCB*

The Operations CCB will be responsible for the configuration control of all operational products (e.g. PROCS, Procedures, ICDs) at launch+60. The chair of the Operations CCB is the Mission Director. All products that exceed the scope of the GLAST Ground System elements (i.e. the MSS) will be under the GLAST Project CCB.

The CCB will use the weekly GOWG meetings as a forum for baselining operational products. The CCB will have representatives from the MOC, GSSC, LAT ISOC, GBM IOC, Spacecraft Manufacturer, Networks, SN and USN where applicable. The CM plan for the Operations CCB is defined in the *Mission Operations Readiness Plan,* which is to be developed and maintained by the FOT.

### *3.3.~~2~~3 Operations Procedures*

During the Normal Operations phase, the operations procedures will be maintained by the FOT with the support of the IOTs for the instrument procedures.

The detailed configuration management plan for the Normal Operations phase for operational products will be contained in the *Mission Operations Readiness Plan,* which is to be developed and maintained by the FOT.

### *3.3.~~3~~4 Project Database (PDB)*

After the L&EO period is complete and Spectrum Astro has delivered the validated post launch Observatory T&C Database, the FOT will take responsibility for maintaining the T&C portion of the PDB. The IOTs will remain responsible for validating any change requests to the respective instrument portions of the PDB. The FOT will validate the overall PDB against the HotBench at the observatory level.

The FOT will continue to deliver the PDB (DFCD-defined format) to the GLAST Science Support Center, Spectrum Astro, LAT and GBM IOCs and PSS as updates are released to maintain synchronization with the MOC systems. The FOT will provide the appropriate MOC configuration control over the PDB and its associated files to ensure that the proper set of files are used for test and operations activities. See Figure 3-6 for post launch +60 PDB flow.

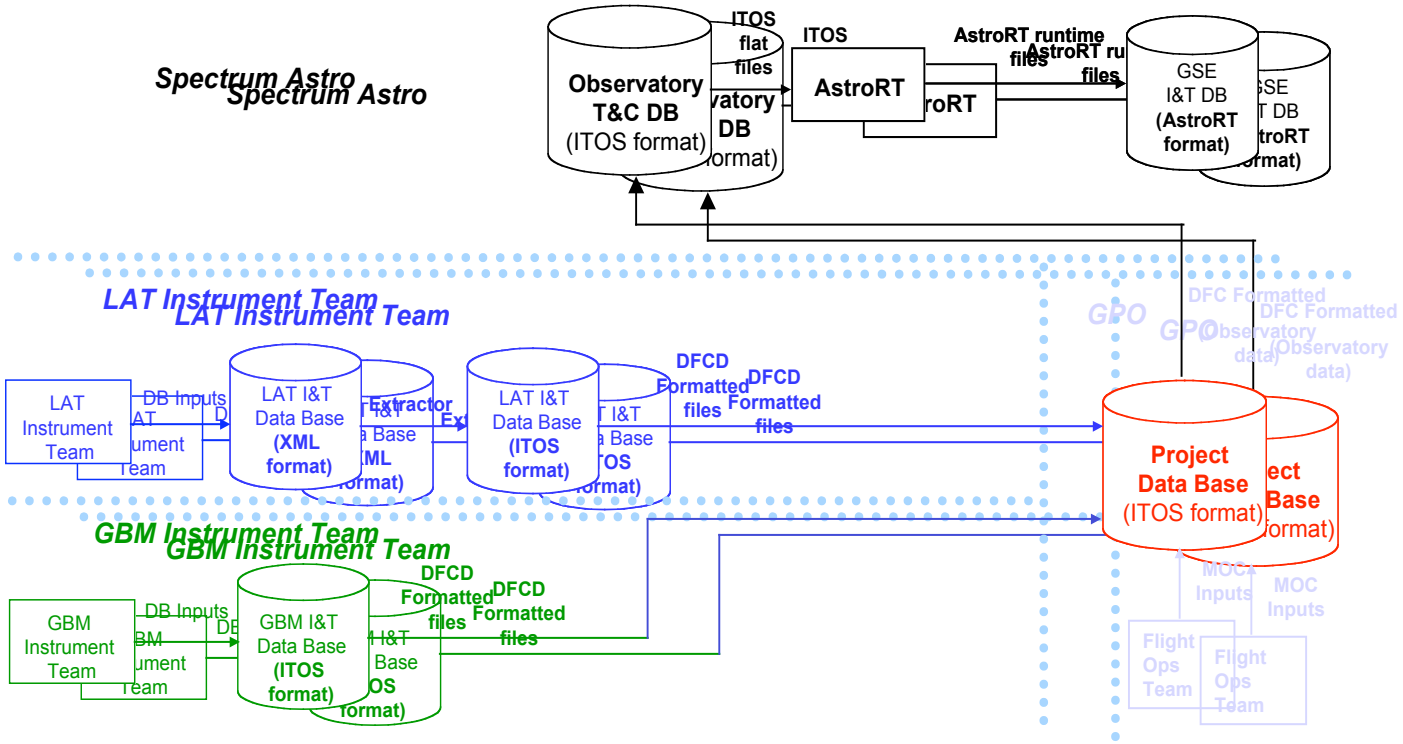



*Figure 3-6: Post Launch +60 Project Database Flow*

### *3.3.~~3~~4.1 PDB Configuration Management (CM)*

The FOT will be responsible for the Configuration Management of the PDB for the Normal Operations phase. The detailed configuration management plan for the Normal Operations phase for operational products will be contained in the *Mission Operations Readiness Plan,* which is to be developed and maintained by the FOT.

The IOTs will be responsible for maintaining CM control over the local databases used as input to the PDB and for review of the PDB instrument content after generation by the FOT.

### *3.3.~~4~~5 PROCs*

During the Normal Operations phase, the PROC generation process will follow the same method, as during the previous mission phases, however Spectrum approval of PROCs is no longer required.

The FOT is responsible for the CM control of all PROCs. The detailed configuration management plan for the Normal Operations phase for operational products will be contained in the *Mission Operations Readiness Plan*.

#### *3.3.~~4~~5.1 Scheduling*

During the Normal Operations phase, activities for science operations will be scheduled through the GSSC (executed via PROC or ATC).

Spacecraft engineering and operations activities will be scheduled by the FOT (executed via PROC or ATC). The IOTs will nominally pass all instrument operational and engineering requests through the GSSC to ensure that there is no impact to the science timeline.

APPENDIX A – ACRONYM LIST

| | |
|---|---|
| AL | Alabama |
| ASI | *Agenzia Spaziale Italiana* (Italian Space Agency) |
| ASINET | ASI Network |
| ATC | Absolute Time Command |
| AZ | Arizona |
| BAM | Burst Alert Message |
| BAP | Burst Alert Processor |
| CCB | Configuration Control Board |
| CCR | Configuration Change Request |
| CDR | Critical Design Review |
| CDRL | Contract Deliverable Requirement List |
| CMS | Configuration Management System |
| CTV | Compatibility Test Van |
| DPF | Data Processing Facility |
| DR | Discrepancy Report |
| DRB | Discrepancy Review Board |
| DSMC | Data Services Management Center |
| ETE | End-to-End |
| F&PR | Functional and Performance Requirements |
| FITS | Flexible Image Transport System |
| FoM | Figure of Merit |
| FOP | Flight Operations Plan |
| FOT | Flight Operations Team |
| FSW | Flight Software |
| GBM | GLAST Burst Monitor |
| GCN | GRB Coordinates Network |
| GI | Guest Investigator |
| GIOC | GBM Instrument Operations Center |
| GLAST | Gamma-Ray Large Area Space Telescope |
| GN | Ground Network |
| GOWG | GLAST Ground Operations Working Group |
| GRB | Gamma-Ray Burst |
| GRT | Ground Readiness Test |
| GRTT | Ground Readiness Test Team |
| GSE | Ground Support Equipment |
| GSFC | Goddard Space Flight Center |
| GSOM | Ground System/Operations Manager |
| GSRD | Ground System Requirements Document |
| GSDR | Ground System Design Review |
| GSSC | GLAST Science Support Center |
| GUC | GLAST User's Committee |
| HEASARC | High Energy Astrophysics Science Archive Research Center |
| ICD | Interface Control Document |
| I&T | Integration & Test |
| IOC | Instrument Operations ~~and science~~ Center |
| IOT | Instrument Operations ~~and science~~ Team |

| | |
|---|---|
| IOWG | Instrument Operations Working Group |
| ISO | International Organization for Standards |
| ISOC | Instrument Science and Operations Center |
| IT | Information Technology |
| ITOS | Integrated Test and Operations System |
| KSC | Kennedy Space Center |
| LAT | Large Area Telescope |
| L&EO | Launch & Early Orbit |
| LD | L&EO Director |
| LISOC | LAT Instrument Science and Operations Control Center |
| MAR | Mission Assurance Requirements |
| MIDEX | Medium-class Explorer |
| MMFD | Multi-Mission Flight Dynamics |
| MOA | Mission Operations Agreement |
| MOC | Mission Operations Center |
| MOM | Mission Operations Manager |
| MOMS | Mission Operations and Mission Services |
| MOR | Mission Operations Review |
| MORP | Mission Operations Readiness Plan |
| MOT | Mission Operations Team |
| MSFC | Marshall Space Flight Center |
| MTS | Mission Testraining Simulator |
| NASA | National Aeronautics and Space Administration |
| NCC | Network Control Center |
| NISN | NASA Integrated Services Network |
| NORAD | North American Air Defense Command |
| NPG | NASA Procedures and Guidelines |
| NSSTC | National Space Science and Technology Center |
| OA | Operations Agreement |
| OCD | Operations Concept Document |
| OODM | Observatory Operations Description Manual |
| ORR | Operations Readiness Review |
| ORT | Operational Readiness Test |
| PDB | Project Data Base |
| PDR | Preliminary Design Review |
| PI | Principal Investigator |
| PSLA | Project Service Level Agreement |
| PSS | Portable Spacecraft Simulator |
| QR | Quality Record |
| QRL | Quality Record List |
| RF | Radio Frequency |
| RFA | Request for Action |
| RT | Real-Time |
| SAI | Spectrum Astro Inc. |
| SAS | Science Analysis Software |
| S/C | Spacecraft |
| SERS | Spacecraft Emergency Response System |
| SLAC | Stanford Linear Accelerator Center |

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|---|---|
| SN | Space Network |
| SNAS | Space Network Access System |
| SOC | Simulations Ops Center |
| SOT | Science Operations Team |
| SRD | System Requirements Document |
| SRR | System Requirements Review |
| SERS | Spacecraft Emergency Response System |
| SNAS | Space Network Access System |
| SSR | Solid State Recorder |
| STDN | Spacecraft Tracking and Data Network |
| SWSI | Space Network (SN) Web Services Interface |
| STOL | Spacecraft Test and Operation Language |
| T&C | Telemetry and Command |
| TBC | To Be Confirmed |
| TBD | To Be Determined |
| TBR | To Be Reviewed |
| TBS | To Be Supplied |
| TCP/IP | Transfer Control Protocol/Internet Protocol |
| TCS | Thermal Control System |
| TDRS | Tracking and Data Relay Satellite |
| TDRSS | Tracking and Data Relay Satellite System |
| TIM | Technical Interchange Meeting |
| TLE | Two-Line Element |
| TLM | Telemetry |
| ToO | Target of Opportunity |
| TVAC | Thermal Vacuum |
| UAH | University of Alabama Huntsville |
| URL | Uniform Resource Locator |
| U.S. | United States of America |
| USN | Universal Space Network |
| VC | Virtual Channel |
| VCU | Virtual Channel Unit |
| WSC | White Sands Complex |
| WWW | World Wide Web |